Cobalt-60 Teletherapy of Intra-oral Cancer

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• **Forty patients with intra-oral cancer were given cobalt-60 teletherapy upon the primary lesion.**

Among the physical advantages of this method are the more precise direction of the beam, reduced scatter and lessened skin and bone effects. The period of observation of patients treated has not been long enough to warrant discussion of cure or permanent arrest, but the consistency and regularity of disappearance of the primary lesion was significant. The authors believe that for intra-oral cancer, cobalt-60 teletherapy should be used before radical surgical procedures are proposed.

THIS IS A PRELIMINARY REPORT of three years' experience with cobalt-60 teletherapy in the treatment of intra-oral cancer. Since the longest period of observation of a patient so treated is two and one-half years, neither cure nor permanent arrest can be said to have been brought about. However, the consistency of response and disappearance of primary lesion with cobalt-60 teletherapy is believed to be significant.

Past experience, including 30 years of work by one of the authors (W.E.C.), has given adequate opportunity to observe the effects of radiation both on the primary growth and upon the patient host. The authors used interstitial applicators such as glass radon seeds, gold radon seeds, removable platinum radon needles, and low-intensity radium element needles, as well as radium element dental molds (made at times in collaboration with a dentist), low voltage x-ray therapy through intra-oral cones, and combination of low voltage intra-oral x-radiation complemented by external irradiation at 200 or 250 kilovolts.

With all of these methods there have been disappearances of primary lesion, and in a few cases there have been five-year arrests of disease. However, all of these methods in some instances have produced painful ulceration which healed slowly or not at all. Likewise, bone necrosis in the mandible, hard palate, or other bony structures has been a not infrequent complication.

In the treatment of intra-oral cancer, as in the treatment of new growths elsewhere, the extent of the lesion is the most important factor in determining prognosis. Rarely will radiation therapy of any type control the primary growth if bone infiltration and necrosis have taken place.

Large cobalt-60 irradiations have been available for only a few years. A teletherapy unit of 1,080 curies was installed at the Los Angeles Tumor Institute in 1952, approximately a year after two similar units had been installed in Canada. The details of construction of this unit have been published previously.[3] It is cylindrical, 3.5 cm. in diameter and 4.3 cm. long. Lead collimators are available to give treatment portals 10 cm. by 10 cm., 10 cm. by 15 cm., and 5 cm., 7.5 cm., and 18 cm. circles. Steel cones fix the treatment distance at 70 cm. A brass filter at the end of the cone absorbs the secondary beta rays from the cone and the collimator to reduce skin reaction.[2]

Among the physical advantages of high energy radiation for deep-seated lesions are increased forward-scatter, and decreased back-scatter and side-scatter. The forward-scatter reduces skin reaction, since maximum ionization is achieved with electron equilibrium about 5 mm. below surface. The increased forward-scatter and decreased back-scatter increase the depth dose relatively and absolutely. As side-scatter is reduced and the beam more sharply demarcated, there is less irradiation of normal tissue at the margin of the beam, and the isodose curves are flatter and more uniform. In addition, with higher energy levels, bone and soft tissue absorption approach a 1:1 ratio. Avoiding the higher ratio associated with lower energy beams reduces the danger of bone damage and necrosis.[1]

In all, 40 patients with intra-oral cancers were treated with cobalt teletherapy. The results are shown in Table 1.

The patients were treated with 10 by 10 cm. opposing portals or opposing 10 by 15 cm. portals used to include the cervical nodes. A daily dose of 300 r in air (240 r tumor dose) alternating right and left fields was given until a tumor dose of 2,400 r was reached—in two weeks, treating five days a week. Mucositis appeared at that stage and the daily dose was reduced to 200 r or 150 r in air (tumor dose of 160 r or 120 r), and treatment was continued at that rate until a total tumor dose of about 6,500 r was reached—in a period of from seven to eight weeks. The mucositis cleared while treatment was

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TABLE 1.—*Initial Response* to Cobalt-60 Teletherapy of Intra-Oral Cancer at Various Sites*

Stage of Lesion	Site of Lesions: Floor of Mouth			Base Tongue, Hypopharynx			Tonsil, Soft Palate, Pharynx		
		Good	Poor		Good	Poor		Good	Poor
Early	8	7	1	4	4	0	7	7	0
Late	6	1	5	7	3	4	8	3	5
Total	14	8	6	11	7	4	15	10	5

* "Good" indicates complete disappearance of the lesion at conclusion of therapy; "poor," any evidence of residual tumor.

going on. The maximum skin reaction, dry epidermitis, was usually reached at about the fourth week. No wet desquamations occurred. Most of the patients were ambulatory and many were able to continue their occupations while undergoing treatment. In many cases antibiotics were given by mouth during the peak of mucous membrane reaction. High-protein, high-carbohydrate, multi-vitamin liquid diet supplements are advocated. In some patients with sensitive mucous membranes, often due to hypovitaminosis and heavy use of tobacco and alcohol, acute mucous membrane reaction necessitated early reduction of daily dosage and prolongation of overall treatment time. Ulceration of the mucosa persisted in only one case in the series. The patient had advanced disease including extension into parotid gland and cervical node metastases at the time treatment was begun. He was alive without demonstrable tumor 18 months after completion of therapy. In one patient, who had tumorous invasion of the mandible with osteomyelitis, the irradiation seemed to do damage to the bone and the disease was not controlled. Although many of the patients had carious teeth, no extractions were done before treatment. The radiation did not cause bony destruction around the teeth.

In some cases palpable nodes within the treatment fields disappeared, but as biopsy was not done before treatment it is not known whether or not they were cancerous. Neck dissection was not done unless nodes were palpable, but the authors believe it should be done if nodes remain palpable or become enlarged after the radiation reaction on the skin has abated.

Results of irradiation in the treatment of large intra-oral cancers (5 cm. or larger) in the past have been so uncertain and unsatisfactory that in recent years the more radical operative procedures—removal of the entire jaw, floor of mouth and the tongue—have been used extensively. It is admitted that in many cases the disease recurs even after these extensive operations. Many patients, fearing they would be unable to appear before the public and that their livelihood would be gone, refuse to undergo such operations.

Although thus far only initial response of tumors and surrounding normal tissue to cobalt-60 teletherapy has been observed, the authors believe that intra-oral lesions should be treated with radiation primarily, and that radical operation should be reserved for the lesions that do not respond. The method of irradiation described does not preclude subsequent radical operation, particularly if the surgical procedure is carried out before late fibrosis occurs.

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REFERENCES

1. Hine, G. J.: Scattering of secondary electrons produced by r-rays in materials of various atomic numbers, Phys. Rev., 82:755-756, June 1951.

2. Johns, H. E.: Radiation Therapy: Depth Dose. Medical Physics, Vol. II, 1950, Year Book Publishers, Inc., Chicago, pp. 790-792.

3. Neil, R. H., Costolow, W. E., and Meland, O. N.: Design and construction of a simple applicator for 1,000 curies of cobalt-60, Radiology, 61:408-410, Sept. 1953.